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## Workplace violence, Psychological Stress, Sleep Quality and Subjective Health in Chinese Doctors : A Large Cross-sectional Study

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**Workplace violence, Psychological Stress, Sleep Quality and Subjective Health in Chinese Doctors: A Large Cross-sectional Study**

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**Keywords:** Physicians; Workplace violence; Stress, Psychological; Sleep Hygiene; Health Personnel

**Number of words:** 4841

## Abstract

**Objectives:** This study had three objectives: (1) to identify the incidence rate of Workplace violence (WPV) against doctors under a new classification, and (2) to examine the association between exposure to WPV, psychological stress, sleep quality, and subjective health of Chinese doctors, (3) to verify the partial mediating role of psychological stress.

**Design:** A large cross-sectional online survey study.

**Setting:** WPV against healthcare workers has aroused great concern recently. Previous studies have made a rough classification toward types of violence. However, the association between WPV, psychological stress, sleep quality, and subjective health of doctors seems to be seldom mentioned.

**Participants:** A total of 3.016 participants were invited across 30 provinces of China in this survey. Ultimately 2.617 doctors completed valid questionnaires.

**Results:** The results demonstrated that the prevalence rate of exposure to verbal abuse was the highest (76.2%), made difficulties (58.3%), smear reputation (40.8%), mobbing behavior (40.2%), menacing behavior (27.6%), physical violence (24.1%), and sexual harassment (7.8%). Exposure to WPV significantly affected the psychological stress, sleep quality, and self-reported health of doctors. Moreover, psychological stress partially mediated the relationship between work-related violence and health damage.

**Conclusion:** In China, most doctors have encountered various WPV from patients and their relatives. The prevalence of three new types of WPV have been investigated in our study, which have been rarely mentioned in past research. A safer work environment for Chinese healthcare workers needs to be provided to minimize health threats, which is a top priority for both

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government and society.

**Strengths and limitations of this study**

We used a large sample and anonymous online questionnaires in our study.

Sample selection was reasonable and representative, and was distributed in 30 provinces of China.

Our study investigates the prevalence of three new types of workplace violence, and explores the relationship between workplace violence and psychological stress, sleep quality, and self-reported health of doctors in China.

In our study we found that psychological stress partially mediated the relationship between work-related violence and health damage.

The approach to self-reports of doctors in an online survey may led to response bias.

**Introduction**

A decade ago, China’s government launched a new round of health system reforms. So far, the medical care insurance system and public health system have been built. In addition, more attention has been paid to the development of primary health services[1]. Although these reforms have achieved much in China, it is still difficult for residents to get medical services and healthcare costs have been rising exponentially [1]. More importantly, Chinese doctors and patients both do not feel that they have profited from the previous series of reforms. On the contrary, the doctor-patient relationship seems to have been deteriorating lately [2].

In China, the human resources for health are seriously insufficient and inequalities exist at the same time [3]. Moreover, there is an imbalance in the resources’ structure. For example the highest quality of health resources are concentrated in large cities, whereas Chinese primary healthcare is still very weak [4]. As a consequence, people tend to flock to public tertiary general hospitals.

Unfortunately, the current medical care insurance system cannot relieve the catastrophic health expenditure [5], and residents often complain about high medical costs. Along with the social change, incompetent medical education, and lack of professionalism in medical staff, most doctors are only busy with aspects of technical problems; all of which result in a lack of awareness at the humanistic level during the process of service. This is an important reason why the doctor-patient relationship is not harmonious in China [6]. Owing to the price of medical services and technology, and income under strictly government-controlled conditions, there is an unreasonable phenomenon where doctors' benefits from medical technology are very low in China. Contrary to what the government wishes, in order to make a profit, some Chinese doctors try to provide unconscionable prescriptions for the patients to earn more money; some often communicating unlawfully with drug/medical appliance dealers. Naturally, the Chinese government attaches much importance to this problem, and many relevant policies have been introduced to solve these issues. Regardless, this phenomenon has caused a large number of adverse effects. Doctor-patient relationships are becoming more and more fragile in China [6], and most patients already do not trust doctors, including all other healthcare staff. In recent years, many doctors have been assaulted, seriously injured, and even murdered by patients or visitors in China. Consequently, doctors are at high risk of serious injury or death in hospital settings caused by attacks from patients. Workplace violence (WPV) against doctors has already become a public health issue and a very common phenomenon in China [7]. Unfortunately, the reports of these incidents by the media have further exacerbated the conflict between doctors and patients. On the other hand, the occupational safety of Chinese doctors has come to a very grave juncture.

## Background

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WPV against healthcare workers is known as violence in healthcare settings, and refers to the violent acts that are directed toward doctors, nurses, or other healthcare staff at work or on duty [8]. It has become an increasingly serious public health problem worldwide but is more common in China [9], and has attracted considerable attention and discussion globally [10]. It is noteworthy that in recent years, WPV has become rampant and is an extensive problem in Chinese healthcare settings. However, it is also an ubiquitous, underreported, and persistent problem that has been tolerated and largely ignored [11]. Since 2000 in China, there is growing evidence that the incidence rate of WPV in healthcare settings has been increasing at about 11% annually [12]; and that the number of incidents of serious violence towards doctors is growing rapidly [7]. These findings demonstrate that China's doctors are facing a severe threat to occupational safety. Furthermore, previous studies indicated that exposure to WPV in healthcare settings could lead to adverse consequences for health professionals, such as a decline in job performance [13], increased turnover intentions and reduced job satisfaction [14], greater stress and burnout [15], low quality of life [16], and so on. Moreover, exposure to violence has a negative effect on the health of hospital staff [17]; and due to the rise of occupational stress, their family life and quality of life is affected as well [18].

Research on WPV in healthcare settings has been widely carried out and revealed antecedent and consequence variables in many previous studies [19 20]. However, most research focused only on physical or psychological violence, the two types of violence that represent only the tip of the iceberg. Classically, WPV is defined by the World Health Organization as *"the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death,*

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4 *psychological harm, maldevelopment, or deprivation”* [21]. According to this definition, obscure  
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6 WPV tends to cause psychological harm, maldevelopment, or deprivation in the practices of  
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8 Chinese healthcare workers. Surprisingly, these types of violence were not considered in previous  
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10 investigations. Thus, a wider range of types should be discussed for violence against healthcare  
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12 workers.  
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16 Still, it is generally known that WPV can cause a large number of adverse outcomes [22-24],  
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18 which have been verified widely, including personal, organizational and social-level outcomes.  
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20 However, there is not enough evidence to test the link between exposure to WPV against doctors,  
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22 psychological stress, sleep quality, and health status in China.  
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26 This study aims to identify the incidence rate of WPV against doctors under a new classification  
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28 by conducting a large cross-sectional online survey; examine the association between exposure to  
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30 WPV, psychological stress, sleep quality, and subjective health of Chinese doctors; and the partial  
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32 mediating role of psychological stress.  
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## 39 **Methods**

### 40 **Subjects and procedures**

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42 An anonymous online questionnaire was completed by doctors throughout the country during May  
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44 2016 in China. This cross-sectional study was conducted across 30 provinces of China. First,  
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46 approximately 50 doctors from the authors' unit were selected as the original deliverers of the  
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48 survey. Subsequently, the colleagues or classmates of “the original deliverers” were invited to  
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50 participate in our online survey. A webpage link to our questionnaire-survey  
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52 (<https://www.wenjuan.com/>) was sent by mobile phone to subjects during doctors' rest breaks.  
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Moreover, the questionnaires were self-administered. A total of 3,016 participants were invited in this survey. Ultimately, 2,617 valid questionnaires were used in the final data analysis. The effective response rate was 86.8%.

The research described in this article meets the guidelines of the Ethics Committee of the College of Public Health, Harbin Medical University, and the project has been approved by the Ethics Committee of the Harbin Medical University (ECHMU). Written informed consent could not be received due to the anonymous survey approach. Hence, oral informed consent for the survey was approved by the ECHMU and obtained from each doctor. Once a questionnaire was completed, it was identified that the doctor has orally agreed to participate in our survey by reference to the Wen's criteria [25].

**Measures**

Measurement of the WPV against doctors

This study used a new measurement tool developed by Zhang to assess the prevalence of WPV [26]. Under the new classification, WPV was divided into seven dimensions, including Verbal Violence (abuse, sarcasm, indignity, effrontery, roar, etc.), Made Difficulties (nit-picking demands, unreasonable-requests, non-compliance, heckling, etc.), Smear Reputation (baseless charges or complaints, slander, impudence for damaging reputation, etc.), Mobbing Behavior (destruction of public facilities, booing, gather together to stir up trouble, public disorder, malicious camera shooting, etc.), Intimidation Behavior (oral or written threats, glower, waving a clenched fist, threatening with weapons, stalking, etc.), Physical Violence (biting, pushing, fighting, cutting, throwing things towards body, etc.) and Sexual Harassment (also including rape or attempts to rape). Until now, made difficulties, smear reputation and mobbing behavior had been seriously

neglected in previous studies. On the contrary, these behaviors very commonly trouble Chinese doctors at work, and exposure to such violence may lead to a great stress for doctors and threaten their well-being. Most importantly, these mistreatment behaviors completely meet the standards for the definition and scope of WPV.

In the present survey, we used a 6-point Likert scale, with “never”, rarely”, “occasionally”, “often”, “frequently” and “every day”, to reflect the frequencies of work-related violence against doctors. At the time of questionnaire coding, “never” and “rarely” were regarded as non-experience of WPV from patients or their relatives. Thus, they were assigned a score of “0.” Other situations were assigned a score of “1,” signifying that these doctors have encountered this type of violence during the past year. The Cronbach’s alpha for the scale was 0.885 in this survey.

### **Measurement of psychological stress, sleep quality and subjective health**

With reference to previous research, psychological stress [17] was used as an item to measure the perceived pressure of doctors, rated on a 5-point Likert scale, ranging from 1 to 5 (1= not at all, 5 = very much). Two single items were addressed together to measure doctors’ self-reported health outcomes (sleep quality & subjective health). Subjective sleep quality [27] was measured by using one item, namely, “How would you evaluate this night’s sleep?”, the response format for which ranged from very bad (1) to very good (4). Additionally, our study consulted the research of Fein and Skinne [28], and estimated overall subjective health by a widely used single-item measure (In general would you say your health is ? 4=excellent, 3=very good, 2=good, 1=fair, poor).

Moreover, this study also captured several demographic details of participants, such as: gender, age, service years, hospital level, marital status, educational categories, and so on.

### **Statistical analysis**

Demographic characteristics of the respondents were collected to report sample information. Pearson’s correlation coefficients were calculated to estimate correlations between the exposure to WPV, psychological stress, sleep quality, and self-subjective health. Multiple hierarchical linear regression analysis was performed to test the effects of groups of independent variables on dependent variables. The demographic variables related to WPV in univariate analysis ( $P<0.05$ ) were entered into step 1 of the hierarchical regression analysis model, to eliminate their interference on the dependent variables. A series of regression analyses were performed to examine our hypotheses according to a procedure that was suggested by Baron & Kenny [19]. The Sobel Test was used in mediation analysis by adopting Preacher’s test program [20]. We provided data including  $F$ ,  $R^2$  and  $R^2$ -changes, and the fit of the model was assessed with  $R^2$ . Standardization regression coefficients ( $\beta$ ) and  $P$  values were calculated for each step in the regression model. In this study, statistical significance was set at  $P < 0.05$ (two-tailed). All of the above analyses were conducted using SPSS 13.0 (SPSS, Inc., Chicago, IL) for Windows.

Results

Demographic characteristics of the respondents

A summary of demographic variables can be seen in Table 1.

Table 1 Characteristics of the respondents (N=2617)

Characteristic	N	%
Age		
18-30	587	22.4
31-40	1224	46.8
41-50	658	25.1
51+	119	4.5

Missing value	29	1.1
<b>Service Years</b>		
0-10	1088	41.6
11-20	720	27.5
30+	376	14.4
Missing value	433	16.5
<b>Hospital level</b>		
Tertiary hospitals	1740	66.6
Secondary hospital	733	28.1
Primary hospital	139	5.3
Missing value	5	2.0
<b>Gender</b>		
Male	1240	47.4
Female	1369	52.3
Missing value	8	3.0
<b>Education</b>		
College degree or below	291	11.1
Bachelor	1350	51.7
Master	692	26.5
Doctor	277	10.6
Missing value	7	3.0
<b>Marital status</b>		
Unmarried	397	15.2
Married	2148	82.1
Divorced or loss of spouse	70	2.7
Missing value	2	1.0
<b>Professional categories</b>		
Without professional title	306	11.7
Resident doctor	564	21.6
Attending physician	898	34.4
Associate chief physician	569	21.8
Chief Physician	270	10.4
Missing value	10	4.0
<b>Shift work</b>		
Often work during the day	503	19.2
Occasional work at night	500	19.1
Often work at night	1613	61.6
Missing value	1	0.1
<b>Working time (hour)</b>		

0-8	528	20.2
9-10	1297	49.6
11-12	504	19.3
13+	285	10.9
Missing value	3	0.1

Prevalence of different styles of WPV against doctors

As shown in Table 2, about 76.2% of participants reported having encountered verbal violence within the last 12 months, which is the highest incidence rate among all kinds of WPV in hospitals. Other incidence rates of WPV from highest to lowest are: made difficulties (58.3%), smear reputation (40.8%), mobbing behavior (40.2%), intimidation behavior (27.6%), physical violence (24.1%) and sexual harassment (7.8%).

Table 2 The incidence rate and rank ordering of WPV against doctors within last 12 months

Violence Styles	N	%	Total	Rank
Verbal Violence	1993	76.2	2616	1
Made Difficulties	1527	58.3	2616	2
Smear Reputation	1068	40.8	2615	3
Mobbing Behavior	1051	40.2	2615	4
Intimidation Behavior	721	27.6	2616	5
Physical Violence	631	24.1	2614	6
Sexual Harassment	203	7.8	2615	7

Incidence rate of accumulated types of expose to WPV against doctors

As shown in Table 3, 83.4% of participants reported having experienced one or more types of WPV during the last 12 months, which indicates that the prevalence of WPV against doctors in China is 83.4%. Further, 18.8% of participants reported having suffered one type of violence, 14.9% of participants reported having encountered two types of violence, 14.1% of participants reported having experienced three types of violence, 11.7% of participants reported having

suffered four types of violence, 9.8% of participants reported having suffered five types of violence, 10.0% of participants reported having suffered six types of violence, and 4.0% of participants reported having suffered seven types of violence.

**Table 3 Incidence rate of accumulated types of WPV against doctors within the last 12 months**

Accumulated Violence	N	%	Valid Percent	Cumulative Percentages
0	433	16.5	16.6	16.6
1 type	491	18.8	18.8	35.4
2 types	389	14.9	14.9	50.3
3 types	370	14.1	14.2	64.4
4 types	305	11.7	11.7	76.1
5 types	256	9.8	9.8	85.9
6 types	263	10.0	10.1	96.0
7 types	105	4.0	4.0	100.0

### Correlations between study variables

The means, standard deviations and Pearson correlation coefficients of continuous variables are shown in Table 4. As the results demonstrate, all variables were significantly correlated with each other. WPV was positively correlated with psychological stress ( $r = 0.382$ ,  $P < 0.001$ ); and negatively associated with subjective sleep quality ( $r = -0.281$ ,  $P < 0.001$ ), and subjective health ( $r = -0.471$ ,  $P < 0.001$ ). Psychological stress was negatively related to subjective sleep quality ( $r = -0.281$ ,  $P < 0.001$ ) and subjective health ( $r = -0.464$ ,  $P < 0.001$ ).

**Table 4 Means (M), standard deviations (SD) and correlations of variables**

Variables	M	SD	1	2	3	4
1. WPV	2.75	2.10	1			
2. Psychological stress	3.33	0.861	0.382**	1		
3. Subjective sleep quality	2.29	0.763	-0.281**	-0.471**	1	
4. Subjective health	2.47	0.643	-0.302**	-0.464**	0.524**	1

\*\*  $p < 0.01$ .

Multiple hierarchical linear regression models of study variables

Multiple hierarchical linear regression analysis was used to evaluate the association between the exposure to WPV, psychological stress, sleep quality, and health status of doctors. Results of mediation analysis showed that psychological stress is a partial mediator in the relationship between violence and sleep quality. Moreover, psychological stress also partially mediated the relationship between violence and subjective health.

Table 5 Multiple hierarchical linear regression models of variables

Variables	Psychological stress		Sleep quality				Subjective health			
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
<b>Control</b>										
<b>Variables</b>										
Age	0.019	0.065	0.059	0.068	0.024	0.053	-0.029	-0.021	-0.070	-0.042
Gender	-0.001	-0.026	-0.009	-0.011	0.007	-0.005	0.013	0.012	0.032	0.022
Service Years	-0.057	-0.061	0.007	-0.020	0.011	-0.016	0.076	0.048	0.082	0.056
Education	0.041	0.039	0.072**	0.093***	0.074***	0.092***	0.042	0.062**	0.044	0.060**
Marital status	0.028	0.033	-0.039	-0.025	-0.041	-0.027	-0.039	-0.025	-0.042	-0.028
Professional categories	0.090**	0.043	-0.044	0.000	-0.010	0.010	-0.081*	-0.038	-0.042	-0.024
<b>Mediating variable</b>										
Psychological stress				-0.488***		-0.448***		-0.479***		-0.424***
<b>Independent variable</b>										
WPV		0.378***			-0.275***	-0.106***			-0.307***	-0.146***
F	4.099***	55.047***	2.163*	97.365***	26.769***	89.137***	2.130*	93.109***	33.397***	89.762***
R <sup>2</sup>	0.011***	0.153***	0.006*	0.242***	0.081***	0.250***	0.006*	0.233***	0.098***	0.251***
ΔR <sup>2</sup>	0.011***	0.141***	0.006*	0.236***	0.075***	0.244***	0.006*	0.227***	0.093***	0.246***

\*  $p < 0.05$ ,  
\*\*  $p < 0.01$ ,  
\*\*\*  $p < 0.001$  (two-tailed).

## Discussion

### New styles and prevalence of WPV against doctors in China

This study discovered that the incidence rate of WPV against Chinese doctors was 83.4%, similar to previous reports [29]. Of all participants in this survey, most have encountered and been victims of at least two styles of violence in the last 12 months. Specifically, exposure to verbal violence was most frequently reported by Chinese doctors with a rate of 76.2%. This result is consistent with previous studies [29 30]. Results in the present study demonstrate that Chinese doctors extensively suffer WPV from patients or their relatives. However, compared to the previous literature, this study specially contributes to the understanding of the types of WPV. Made difficulties, smear reputation, and mobbing behavior were proposed first in this study, and it verified that the three new styles of violence defined in our study appeared to be more common than physical violence in hospital settings. Their respective incidence rates were, 58.3% (Rank 2), 40.8% (Rank 3), and 40.2% (Rank 4). Additionally, the incidence rate of physical violence and sexual harassment was 24.1% and 7.8%. Indeed, physical violence must inflict greater harm on the doctors, but the type of widespread violence found in this study is more likely to harm healthcare staff continually.

### The adverse effects of WPV against doctors and the partial mediatory effects of psychological stress

As its name implies, WPV threatens the well-being of doctors, which we have demonstrated in our findings. Consistent with previous observations [31], exposure to WPV had a negative influence on Chinese doctors' subjective sleep quality and health status. There is reciprocal causation between the doctor-patient relationship and violence towards doctors [2]. Although previous



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literature has discussed numerous causes of WPV and specially their unique characteristics in China, it is not the focus our discussion [32] However, it is undeniably true that the level of tension in the doctor-patient relationship has further intensified following the increase of WPV [33]. It is incredible to see that some Chinese netizens unexpectedly support these violent events, and a gradual formation of hatred towards doctors among Chinese patients; thus, the doctor-patient relationship has reached an unprecedentedly poor condition. Under these circumstances, Chinese doctors tend to specifically allocate much of their attention in dealing with the doctor-patient relationship, in order to protect themselves against violence from patients or patients' relatives. Therefore, doctors need to carefully express every word and input more "emotional labor" [34] when they directly face the patient or relatives to avoid the complain. The conservation of resources (CORs) theory emphasizes the view that *"people strive to obtain, retain and protect that which they value"* [35]. From a COR standpoint, in order to avoid exposure to WPV, Chinese doctors are prone to invest more resources such as extra time and energy in dealing with the doctor-patient relationship. On the one hand, the resource investment represents the accumulative job demands of a doctor; on the other hand, they suffer from the patient's violence. In this case, two aspects may trigger feelings of distress and outrage in a doctor. It is an inequitable cost-reward evaluation of a doctor's professional and emotional investment, resulting in a process of resource depletion for the doctor. This state of resource depletion is closely related to stress, burnout, and depression [36]. More than that, a large number of previous studies have shown that effort-reward imbalance can lead to adverse health outcomes [37-39]. In turn, the psychological stress that plays a mediating role, further causes sleep disturbance and health damage for a doctor, which is an innovative contribution to research on exposure to WPV in a

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4 medical setting.  
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### 8 9 **Limitations**

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11 Although there are significant discoveries in the present study, it has several limitations. First, a  
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13 convenient sample was used, which risks the potential for sampling bias. Second, its  
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15 cross-sectional nature prevented the establishment of a causal relationship between variables.  
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17 Therefore, one important suggestion is that longitudinal studies should be conducted in the future.  
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19 Third, the data were collected from the self-reports of doctors in an online survey, which may have  
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21 led to response bias due to social desirability or negative effect. Moreover, the survey process of  
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23 survey could not be monitored. The doctors might have overestimated or underestimated the  
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25 association between the study variables.  
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### 34 35 **Conclusions**

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37 The findings indicate that 83.4% of participants reported that they had suffered more than one type  
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39 of WPV. Exposure to WPV toward healthcare workers is common. All the seven styles of WPV  
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41 were found among Chinese doctors. The incidence rate of violence from high to low are verbal  
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43 abuse, made difficulties, smear reputation, mobbing behavior, menace behavior, physical violence  
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45 and sexual harassment. This study also demonstrated that WPV was associated with psychological  
46  
47 stress, sleep quality, and subjective health. Finally, this study made a new discovery regarding a  
48  
49 rarely mentioned variable in the previous literature; psychological stress played a mediating role  
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51 in the relationship between exposure to violence and health damage.  
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57 **Acknowledgments:** This study was funded by the Innovation Science Research Foundation of  
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**Author Contributions:** Conceived and designed the study: Tao Sun, Lei Gao and Fujun Li designed this study; Sun Tao, Lei Gao and Fujun Li drafted the manuscript; Yu Shi , Feng-Zhe Xie , Jing-Hui Wang, Shuo Wang, and Shu-E Zhang collected data and controlled quality; Wen-Hui Liu, Xiaojian Duan , Xinyan Liu , Zhong Zhang, Li Li and Li-Hua Fan conducted the data analyses. All authors contributed to publishing the final manuscript.

**Competing Interests:** The authors have declared that no competing interests exist.

**Ethics:** This study was approved by the ethics committee of the College of Public Health, Harbin Medical University. Due to the anonymous survey approach, the written informed consent could not be received; therefore, oral informed consent for survey was approved by the Ethics Committee of Harbin Medical University and obtained from each participant.

**Data sharing statement:** No additional data are available.

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# BMJ Open

## Workplace violence, Psychological Stress, Sleep Quality and Subjective Health in Chinese Doctors : A Large Cross-sectional Study

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Manuscripts

**Workplace violence, Psychological Stress, Sleep Quality and Subjective Health in Chinese Doctors: A Large Cross-sectional Study**

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**Keywords:** Physicians; Workplace violence; Stress, Psychological; Sleep Hygiene; Health Personnel

**Number of words:** 4841

## Abstract

**Objectives:** This study had three objectives: (1) to identify the incidence rate of Workplace violence (WPV) against doctors under a new classification, and (2) to examine the association between exposure to WPV, psychological stress, sleep quality, and subjective health of Chinese doctors, (3) to verify the partial mediating role of psychological stress.

**Design:** A large cross-sectional online survey study.

**Setting:** WPV against healthcare workers has aroused great concern recently. Previous studies have made a rough classification toward types of violence. However, the association between WPV, psychological stress, sleep quality, and subjective health of doctors seems to be seldom mentioned.

**Participants:** A total of 3.016 participants were invited across 30 provinces of China in this survey. Ultimately 2.617 doctors completed valid questionnaires.

**Results:** The results demonstrated that the prevalence rate of exposure to verbal abuse was the highest (76.2%), made difficulties (58.3%), smear reputation (40.8%), mobbing behavior (40.2%), menacing behavior (27.6%), physical violence (24.1%), and sexual harassment (7.8%). Exposure to WPV significantly affected the psychological stress, sleep quality, and self-reported health of doctors. Moreover, psychological stress partially mediated the relationship between work-related violence and health damage.

**Conclusion:** In China, most doctors have encountered various WPV from patients and their relatives. The prevalence of three new types of WPV have been investigated in our study, which have been rarely mentioned in past research. A safer work environment for Chinese healthcare workers needs to be provided to minimize health threats, which is a top priority for both

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government and society.

**Strengths and limitations of this study**

We used a large sample and anonymous online questionnaires in our study.

Sample selection was reasonable and representative, and was distributed in 30 provinces of China.

Our study investigates the prevalence of three new types of workplace violence, and explores the relationship between workplace violence and psychological stress, sleep quality, and self-reported health of doctors in China.

In our study we found that psychological stress partially mediated the relationship between work-related violence and health damage.

The approach to self-reports of doctors in an online survey may led to response bias.

**Introduction**

A decade ago, China’s government launched a new round of health system reforms. So far, the medical care insurance system and public health system have been built. In addition, more attention has been paid to the development of primary health services[1]. Although these reforms have achieved much in China, it is still difficult for residents to get medical services and healthcare costs have been rising exponentially [1]. More importantly, Chinese doctors and patients both do not feel that they have profited from the previous series of reforms. On the contrary, the doctor-patient relationship seems to have been deteriorating lately [2].

In China, the human resources for health are seriously insufficient and inequalities exist at the same time [3]. Moreover, there is an imbalance in the resources’ structure. For example the highest quality of health resources are concentrated in large cities, whereas Chinese primary healthcare is still very weak [4]. As a consequence, people tend to flock to public tertiary general hospitals.

Unfortunately, the current medical care insurance system cannot relieve the catastrophic health expenditure [5], and residents often complain about high medical costs. Along with the social change, incompetent medical education, and lack of professionalism in medical staff, most doctors are only busy with aspects of technical problems; all of which result in a lack of awareness at the humanistic level during the process of service. This is an important reason why the doctor-patient relationship is not harmonious in China [6]. Owing to the price of medical services and technology, and income under strictly government-controlled conditions, there is an unreasonable phenomenon where doctors' benefits from medical technology are very low in China. Contrary to what the government wishes, in order to make a profit, some Chinese doctors try to provide unconscionable prescriptions for the patients to earn more money; some often communicating unlawfully with drug/medical appliance dealers. Naturally, the Chinese government attaches much importance to this problem, and many relevant policies have been introduced to solve these issues. Regardless, this phenomenon has caused a large number of adverse effects. Doctor-patient relationships are becoming more and more fragile in China [6], and most patients already do not trust doctors, including all other healthcare staff. In recent years, many doctors have been assaulted, seriously injured, and even murdered by patients or visitors in China. Consequently, doctors are at high risk of serious injury or death in hospital settings caused by attacks from patients. Workplace violence (WPV) against doctors has already become a public health issue and a very common phenomenon in China [7]. Unfortunately, the reports of these incidents by the media have further exacerbated the conflict between doctors and patients. On the other hand, the occupational safety of Chinese doctors has come to a very grave juncture.

## Background

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WPV against healthcare workers is known as violence in healthcare settings, and refers to the violent acts that are directed toward doctors, nurses, or other healthcare staff at work or on duty [8]. It has become an increasingly serious public health problem worldwide but is more common in China [9], and has attracted considerable attention and discussion globally [10]. It is noteworthy that in recent years, WPV has become rampant and is an extensive problem in Chinese healthcare settings. However, it is also an ubiquitous, underreported, and persistent problem that has been tolerated and largely ignored [11]. Since 2000 in China, there is growing evidence that the incidence rate of WPV in healthcare settings has been increasing at about 11% annually [12]; and that the number of incidents of serious violence towards doctors is growing rapidly [7]. These findings demonstrate that China’s doctors are facing a severe threat to occupational safety. Furthermore, previous studies indicated that exposure to WPV in healthcare settings could lead to adverse consequences for health professionals, such as a decline in job performance [13], increased turnover intentions and reduced job satisfaction [14], greater stress and burnout [15], low quality of life [16], and so on. Moreover, exposure to violence has a negative effect on the health of hospital staff [17]; and due to the rise of occupational stress, their family life and quality of life is affected as well [18].

Research on WPV in healthcare settings has been widely carried out and revealed antecedent and consequence variables in many previous studies [19 20]. However, most research focused only on physical or psychological violence, the two types of violence that represent only the tip of the iceberg. Classically, WPV is defined by the World Health Organization as “*the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death,*

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4 *psychological harm, maldevelopment, or deprivation”* [21]. According to this definition, obscure  
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6 WPV tends to cause psychological harm, maldevelopment, or deprivation in the practices of  
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8 Chinese healthcare workers. Surprisingly, these types of violence were not considered in previous  
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10 investigations. Thus, a wider range of types should be discussed for violence against healthcare  
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16 Still, it is generally known that WPV can cause a large number of adverse outcomes [22-24],  
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18 which have been verified widely, including personal, organizational and social-level outcomes.  
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20 However, there is not enough evidence to test the link between exposure to WPV against doctors,  
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22 psychological stress, sleep quality, and health status in China.  
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26 This study aims to identify the incidence rate of WPV against doctors under a new classification  
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28 by conducting a large cross-sectional online survey; examine the association between exposure to  
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30 WPV, psychological stress, sleep quality, and subjective health of Chinese doctors; and the partial  
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32 mediating role of psychological stress.  
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## 39 **Methods**

### 40 **Subjects and procedures**

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43 An anonymous online questionnaire was completed by doctors throughout the country during May  
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45 2016 in China. This cross-sectional study was conducted across 30 provinces of China. First,  
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47 approximately 50 doctors from the authors' unit were selected as the original deliverers of the  
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49 survey. Subsequently, the colleagues or classmates of “the original deliverers” were invited to  
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51 participate in our online survey. A webpage link to our questionnaire-survey  
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Moreover, the questionnaires were self-administered. A total of 3,016 participants were invited in this survey. Ultimately, 2,617 valid questionnaires were used in the final data analysis. The effective response rate was 86.8%.

The research described in this article meets the guidelines of the Ethics Committee of the College of Public Health, Harbin Medical University, and the project has been approved by the Ethics Committee of the Harbin Medical University (ECHMU). Written informed consent could not be received due to the anonymous survey approach. Hence, oral informed consent for the survey was approved by the ECHMU and obtained from each doctor. Once a questionnaire was completed, it was identified that the doctor has orally agreed to participate in our survey by reference to the Wen’s criteria [25].

**Measures**

Measurement of the WPV against doctors

This study used a new measurement tool developed by Zhang to assess the prevalence of WPV [26]. Under the new classification, WPV was divided into seven dimensions, including Verbal Violence (abuse, sarcasm, indignity, effrontery, roar, etc.), Made Difficulties (nit-picking demands, unreasonable-requests, non-compliance, heckling, etc.), Smear Reputation (baseless charges or complaints, slander, impudence for damaging reputation, etc.), Mobbing Behavior (destruction of public facilities, booing, gather together to stir up trouble, public disorder, malicious camera shooting, etc.), Intimidation Behavior (oral or written threats, glower, waving a clenched fist, threatening with weapons, stalking, etc.), Physical Violence (biting, pushing, fighting, cutting, throwing things towards body, etc.) and Sexual Harassment (also including rape or attempts to rape). Until now, made difficulties, smear reputation and mobbing behavior had been seriously

neglected in previous studies. On the contrary, these behaviors very commonly trouble Chinese doctors at work, and exposure to such violence may lead to a great stress for doctors and threaten their well-being. Most importantly, these mistreatment behaviors completely meet the standards for the definition and scope of WPV.

In the present survey, we used a 6-point Likert scale, with “never”, rarely”, “occasionally”, “often”, “frequently” and “every day”, to reflect the frequencies of work-related violence against doctors. At the time of questionnaire coding, “never” and “rarely” were regarded as non-experience of WPV from patients or their relatives. Thus, they were assigned a score of “0.” Other situations were assigned a score of “1,” signifying that these doctors have encountered this type of violence during the past year. The Cronbach’s alpha for the scale was 0.885 in this survey.

### **Measurement of psychological stress, sleep quality and subjective health**

With reference to previous research, psychological stress [17] was used as an item to measure the perceived pressure of doctors, rated on a 5-point Likert scale, ranging from 1 to 5 (1= not at all, 5 = very much). Two single items were addressed together to measure doctors’ self-reported health outcomes (sleep quality & subjective health). Subjective sleep quality [27] was measured by using one item, namely, “How would you evaluate this night’s sleep?”, the response format for which ranged from very bad (1) to very good (4). Additionally, our study consulted the research of Fein and Skinne [28], and estimated overall subjective health by a widely used single-item measure (In general would you say your health is ? 4=excellent, 3=very good, 2=good, 1=fair, poor).

Moreover, this study also captured several demographic details of participants, such as: gender, age, service years, hospital level, marital status, educational categories, and so on.

### **Statistical analysis**

Demographic characteristics of the respondents were collected to report sample information. Pearson’s correlation coefficients were calculated to estimate correlations between the exposure to WPV, psychological stress, sleep quality, and self-subjective health. Multiple hierarchical linear regression analysis was performed to test the effects of groups of independent variables on dependent variables. The demographic variables related to WPV in univariate analysis ( $P<0.05$ ) were entered into step 1 of the hierarchical regression analysis model, to eliminate their interference on the dependent variables. A series of regression analyses were performed to examine our hypotheses according to a procedure that was suggested by Baron & Kenny [19]. The Sobel Test was used in mediation analysis by adopting Preacher’s test program [20]. We provided data including  $F$ ,  $R^2$  and  $R^2$ -changes, and the fit of the model was assessed with  $R^2$ . Standardization regression coefficients ( $\beta$ ) and  $P$  values were calculated for each step in the regression model. In this study, statistical significance was set at  $P < 0.05$ (two-tailed). All of the above analyses were conducted using SPSS 13.0 (SPSS, Inc., Chicago, IL) for Windows.

Results

Demographic characteristics of the respondents

A summary of demographic variables can be seen in Table 1.

Table 1 Characteristics of the respondents (N=2617)

Characteristic	N	%
Age		
18-30	587	22.4
31-40	1224	46.8
41-50	658	25.1
51+	119	4.5

Missing value	29	1.1
<b>Service Years</b>		
0-10	1088	41.6
11-20	720	27.5
30+	376	14.4
Missing value	433	16.5
<b>Hospital level</b>		
Tertiary hospitals	1740	66.6
Secondary hospital	733	28.1
Primary hospital	139	5.3
Missing value	5	2.0
<b>Gender</b>		
Male	1240	47.4
Female	1369	52.3
Missing value	8	3.0
<b>Education</b>		
College degree or below	291	11.1
Bachelor	1350	51.7
Master	692	26.5
Doctor	277	10.6
Missing value	7	3.0
<b>Marital status</b>		
Unmarried	397	15.2
Married	2148	82.1
Divorced or loss of spouse	70	2.7
Missing value	2	1.0
<b>Professional categories</b>		
Without professional title	306	11.7
Resident doctor	564	21.6
Attending physician	898	34.4
Associate chief physician	569	21.8
Chief Physician	270	10.4
Missing value	10	4.0
<b>Shift work</b>		
Often work during the day	503	19.2
Occasional work at night	500	19.1
Often work at night	1613	61.6
Missing value	1	0.1
<b>Working time (hour)</b>		

0-8	528	20.2
9-10	1297	49.6
11-12	504	19.3
13+	285	10.9
Missing value	3	0.1

Prevalence of different styles of WPV against doctors

As shown in Table 2, about 76.2% of participants reported having encountered verbal violence within the last 12 months, which is the highest incidence rate among all kinds of WPV in hospitals. Other incidence rates of WPV from highest to lowest are: made difficulties (58.3%), smear reputation (40.8%), mobbing behavior (40.2%), intimidation behavior (27.6%), physical violence (24.1%) and sexual harassment (7.8%).

Table 2 The incidence rate and rank ordering of WPV against doctors within last 12 months

Violence Styles	N	%	Total	Rank
Verbal Violence	1993	76.2	2616	1
Made Difficulties	1527	58.3	2616	2
Smear Reputation	1068	40.8	2615	3
Mobbing Behavior	1051	40.2	2615	4
Intimidation Behavior	721	27.6	2616	5
Physical Violence	631	24.1	2614	6
Sexual Harassment	203	7.8	2615	7

Incidence rate of accumulated types of expose to WPV against doctors

As shown in Table 3, 83.4% of participants reported having experienced one or more types of WPV during the last 12 months, which indicates that the prevalence of WPV against doctors in China is 83.4%. Further, 18.8% of participants reported having suffered one type of violence, 14.9% of participants reported having encountered two types of violence, 14.1% of participants reported having experienced three types of violence, 11.7% of participants reported having

suffered four types of violence, 9.8% of participants reported having suffered five types of violence, 10.0% of participants reported having suffered six types of violence, and 4.0% of participants reported having suffered seven types of violence.

**Table 3 Incidence rate of accumulated types of WPV against doctors within the last 12 months**

Accumulated Violence	N	%	Valid Percent	Cumulative Percentages
0	433	16.5	16.6	16.6
1 type	491	18.8	18.8	35.4
2 types	389	14.9	14.9	50.3
3 types	370	14.1	14.2	64.4
4 types	305	11.7	11.7	76.1
5 types	256	9.8	9.8	85.9
6 types	263	10.0	10.1	96.0
7 types	105	4.0	4.0	100.0

### Correlations between study variables

The means, standard deviations and Pearson correlation coefficients of continuous variables are shown in Table 4. As the results demonstrate, all variables were significantly correlated with each other. WPV was positively correlated with psychological stress ( $r = 0.382$ ,  $P < 0.001$ ); and negatively associated with subjective sleep quality ( $r = -0.281$ ,  $P < 0.001$ ), and subjective health ( $r = -0.471$ ,  $P < 0.001$ ). Psychological stress was negatively related to subjective sleep quality ( $r = -0.281$ ,  $P < 0.001$ ) and subjective health ( $r = -0.464$ ,  $P < 0.001$ ).

**Table 4 Means (M), standard deviations (SD) and correlations of variables**

Variables	M	SD	1	2	3	4
1. WPV	2.75	2.10	1			
2. Psychological stress	3.33	0.861	0.382**	1		
3. Subjective sleep quality	2.29	0.763	-0.281**	-0.471**	1	
4. Subjective health	2.47	0.643	-0.302**	-0.464**	0.524**	1

\*\*  $p < 0.01$ .

Multiple hierarchical linear regression models of study variables

Multiple hierarchical linear regression analysis was used to evaluate the association between the exposure to WPV, psychological stress, sleep quality, and health status of doctors. Results of mediation analysis showed that psychological stress is a partial mediator in the relationship between violence and sleep quality. Moreover, psychological stress also partially mediated the relationship between violence and subjective health.

Table 5 Multiple hierarchical linear regression models of variables

Variables	Psychological stress		Sleep quality				Subjective health			
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
<b>Control</b>										
<b>Variables</b>										
Age	0.019	0.065	0.059	0.068	0.024	0.053	-0.029	-0.021	-0.070	-0.042
Gender	-0.001	-0.026	-0.009	-0.011	0.007	-0.005	0.013	0.012	0.032	0.022
Service Years	-0.057	-0.061	0.007	-0.020	0.011	-0.016	0.076	0.048	0.082	0.056
Education	0.041	0.039	0.072**	0.093***	0.074***	0.092***	0.042	0.062**	0.044	0.060**
Marital status	0.028	0.033	-0.039	-0.025	-0.041	-0.027	-0.039	-0.025	-0.042	-0.028
Professional categories	0.090**	0.043	-0.044	0.000	-0.010	0.010	-0.081*	-0.038	-0.042	-0.024
<b>Mediating variable</b>										
Psychological stress				-0.488***		-0.448***		-0.479***		-0.424***
<b>Independent variable</b>										
WPV		0.378***			-0.275***	-0.106***			-0.307***	-0.146***
F	4.099***	55.047***	2.163*	97.365***	26.769***	89.137***	2.130*	93.109***	33.397***	89.762***
R <sup>2</sup>	0.011***	0.153***	0.006*	0.242***	0.081***	0.250***	0.006*	0.233***	0.098***	0.251***
ΔR <sup>2</sup>	0.011***	0.141***	0.006*	0.236***	0.075***	0.244***	0.006*	0.227***	0.093***	0.246***

\*  $p < 0.05$ ,  
\*\*  $p < 0.01$ ,  
\*\*\*  $p < 0.001$  (two-tailed).

## Discussion

### New styles and prevalence of WPV against doctors in China

This study discovered that the incidence rate of WPV against Chinese doctors was 83.4%, similar to previous reports [29]. Of all participants in this survey, most have encountered and been victims of at least two styles of violence in the last 12 months. Specifically, exposure to verbal violence was most frequently reported by Chinese doctors with a rate of 76.2%. This result is consistent with previous studies [29 30]. Results in the present study demonstrate that Chinese doctors extensively suffer WPV from patients or their relatives. However, compared to the previous literature, this study specially contributes to the understanding of the types of WPV. Made difficulties, smear reputation, and mobbing behavior were proposed first in this study, and it verified that the three new styles of violence defined in our study appeared to be more common than physical violence in hospital settings. Their respective incidence rates were, 58.3% (Rank 2), 40.8% (Rank 3), and 40.2% (Rank 4). Additionally, the incidence rate of physical violence and sexual harassment was 24.1% and 7.8%. Indeed, physical violence must inflict greater harm on the doctors, but the type of widespread violence found in this study is more likely to harm healthcare staff continually.

### The adverse effects of WPV against doctors and the partial mediatory effects of psychological stress

As its name implies, WPV threatens the well-being of doctors, which we have demonstrated in our findings. Consistent with previous observations [31], exposure to WPV had a negative influence on Chinese doctors' subjective sleep quality and health status. There is reciprocal causation between the doctor-patient relationship and violence towards doctors [2]. Although previous



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literature has discussed numerous causes of WPV and specially their unique characteristics in China, it is not the focus our discussion [32] However, it is undeniably true that the level of tension in the doctor-patient relationship has further intensified following the increase of WPV [33]. It is incredible to see that some Chinese netizens unexpectedly support these violent events, and a gradual formation of hatred towards doctors among Chinese patients; thus, the doctor-patient relationship has reached an unprecedentedly poor condition. Under these circumstances, Chinese doctors tend to specifically allocate much of their attention in dealing with the doctor-patient relationship, in order to protect themselves against violence from patients or patients' relatives. Therefore, doctors need to carefully express every word and input more "emotional labor" [34] when they directly face the patient or relatives to avoid the complain. The conservation of resources (CORs) theory emphasizes the view that *"people strive to obtain, retain and protect that which they value"* [35]. From a COR standpoint, in order to avoid exposure to WPV, Chinese doctors are prone to invest more resources such as extra time and energy in dealing with the doctor-patient relationship. On the one hand, the resource investment represents the accumulative job demands of a doctor; on the other hand, they suffer from the patient's violence. In this case, two aspects may trigger feelings of distress and outrage in a doctor. It is an inequitable cost-reward evaluation of a doctor's professional and emotional investment, resulting in a process of resource depletion for the doctor. This state of resource depletion is closely related to stress, burnout, and depression [36]. More than that, a large number of previous studies have shown that effort-reward imbalance can lead to adverse health outcomes [37-39]. In turn, the psychological stress that plays a mediating role, further causes sleep disturbance and health damage for a doctor, which is an innovative contribution to research on exposure to WPV in a

medical setting.

### Limitations

Although there are significant discoveries in the present study, it has several limitations. First, a convenient sample was used, which risks the potential for sampling bias. Second, its cross-sectional nature prevented the establishment of a causal relationship between variables. Therefore, one important suggestion is that longitudinal studies should be conducted in the future. Third, the data were collected from the self-reports of doctors in an online survey, which may have led to response bias due to social desirability or negative effect. Moreover, the survey process of survey could not be monitored. The doctors might have overestimated or underestimated the association between the study variables.

### Conclusions

The findings indicate that 83.4% of participants reported that they had suffered more than one type of WPV. Exposure to WPV toward healthcare workers is common. All the seven styles of WPV were found among Chinese doctors. The incidence rate of violence from high to low are verbal abuse, made difficulties, smear reputation, mobbing behavior, menace behavior, physical violence and sexual harassment. This study also demonstrated that WPV was associated with psychological stress, sleep quality, and subjective health. Finally, this study made a new discovery regarding a rarely mentioned variable in the previous literature; psychological stress played a mediating role in the relationship between exposure to violence and health damage.

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**Author Contributions:** Conceived and designed the study: Tao Sun, Lei Gao and Fujun Li designed this study; Sun Tao, Lei Gao and Fujun Li drafted the manuscript; Yu Shi , Feng-Zhe Xie , Jing-Hui Wang, Shuo Wang, and Shu-E Zhang collected data and controlled quality; Wen-Hui Liu, Xiaojian Duan , Xinyan Liu , Zhong Zhang, Li Li and Li-Hua Fan conducted the data analyses. All authors contributed to publishing the final manuscript.

**Competing Interests:** The authors have declared that no competing interests exist.

**Ethics:** This study was approved by the ethics committee of the College of Public Health, Harbin Medical University. Due to the anonymous survey approach, the written informed consent could not be received; therefore, oral informed consent for survey was approved by the Ethics Committee of Harbin Medical University and obtained from each participant.

**Data sharing statement:** No additional data are available.

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	Page 1, line 2; p. 2 , line 11
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	P.2 ; line 20; p.3, line 1-14
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	p.5, line 5-22; p.6, line 1-19
Objectives	3	State specific objectives, including any prespecified hypotheses	P.6, line 20-22; p.7, line 1
Methods			
Study design	4	Present key elements of study design early in the paper	P.7, line 4-13
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	p.7, line 4-13
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	P.7, line 7-10
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	no
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	P.7, line 22; p.8; p.9, line 1-9
Bias	9	Describe any efforts to address potential sources of bias	no
Study size	10	Explain how the study size was arrived at	no

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	p.9, line 10-22; p.10, line 1
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	P.9, line 11-15
		(b) Describe any methods used to examine subgroups and interactions	no
		(c) Explain how missing data were addressed	no
		(d) If applicable, describe analytical methods taking account of sampling strategy	P.9, line 15-22
		(e) Describe any sensitivity analyses	no
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	P.7, line 11-12
		(b) Give reasons for non-participation at each stage	no
		(c) Consider use of a flow diagram	No
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	P.10; p.11
		(b) Indicate number of participants with missing data for each variable of interest	P.10; p.11
Outcome data	15*	Report numbers of outcome events or summary measures	P.11; p.12; p.13; p.14
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	P.9, line 15-17
		(b) Report category boundaries when continuous variables were categorized	no
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	no
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	no
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	P.14, line 15-25; p.15. Line 1-19
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and	P. 16, Line 13-22;

		magnitude of any potential bias	p.17, line 1-7
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	P.15, line 9-22; p.16, line 1-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	no
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	P.17, line 22; p.18, line 2

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Workplace violence, Psychological Stress, Sleep Quality and Subjective Health in Chinese Doctors : A Large Cross-sectional Study

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Keywords:	Workplace violence, Physicians, Stress, Psychological, Sleep Hygiene, Health Personnel

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**Workplace violence, Psychological Stress, Sleep Quality and Subjective Health in Chinese Doctors: A Large Cross-sectional Study**

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**Keywords:** Physicians; Workplace violence; Stress, Psychological; Sleep Hygiene; Health Personnel

**Number of words:** 3500

## Abstract

**Background:** Workplace violence (WPV) against healthcare workers is known as violence in healthcare settings, and referring to the violent acts that are directed toward doctors, nurses, or other healthcare staff at work or on duty. Moreover, WPV can cause a large number of adverse outcomes. However, there is not enough evidence to test the link between exposure to WPV against doctors, psychological stress, sleep quality, and health status in China.

**Objectives:** This study had three objectives: (1) to identify the incidence rate of Workplace WPV against doctors under a new classification, and (2) to examine the association between exposure to WPV, psychological stress, sleep quality, and subjective health of Chinese doctors, (3) to verify the partial mediating role of psychological stress.

**Design:** A cross-sectional online survey study.

**Setting:** The survey was conducted among 1740 tertiary hospitals, 733 secondary hospital and 139 primary hospital across 30 provinces of China.

**Participants:** A total of 3,016 participants were invited. Ultimately 2,617 doctors completed valid questionnaires. The effective response rate was 86.8%.

**Results:** The results demonstrated that the prevalence rate of exposure to verbal abuse was the highest (76.2%), made difficulties (58.3%), smear reputation (40.8%), mobbing behavior (40.2%), menacing behavior (27.6%), physical violence (24.1%), and sexual harassment (7.8%). Exposure to WPV significantly affected the psychological stress, sleep quality, and self-reported health of doctors. Moreover, psychological stress partially mediated the relationship between work-related violence and health damage.

**Conclusion:** In China, most doctors have encountered various WPV from patients and their

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relatives. The prevalence of three new types of WPV have been investigated in our study, which have been rarely mentioned in past research. A safer work environment for Chinese healthcare workers needs to be provided to minimize health threats, which is a top priority for both government and society.

**Strengths and limitations of this study**

The prevalence of three new accessorial types of workplace violence is conducted in this study, with high response rates.

This is the first study investigating the relationship between workplace violence and psychological stress, sleep quality, and self-reported health of doctors in China.

The finding that psychological stress partially mediated the relationship between work-related violence and health damage is first reported.

The approach to self-reports of doctors in an online survey may led to response bias.

Causation is unable to be established due to cross-sectional study design.

The results of the study are not generalizable to all Chinese doctors.

**Introduction**

A decade ago, China’s government launched a new round of health system reforms. So far, the medical care insurance system and public health system have been built. In addition, more attention has been paid to the development of primary health services .<sup>1</sup> Although these reforms have achieved much in China, it is still difficult for residents to get medical services and healthcare costs have been rising exponentially .<sup>1</sup> More importantly, Chinese doctors and patients both do not feel that they have profited from the previous series of reforms. On the contrary, the

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4 doctor-patient relationship seems to have been deteriorating lately.<sup>2</sup>

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6 In China, the human resources for health are seriously insufficient and inequalities exist at the  
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8 same time.<sup>3</sup> Moreover, there is an imbalance in the resources' structure. For example the highest  
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10 quality of health resources are concentrated in large cities, whereas Chinese primary healthcare is  
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12 still very weak.<sup>4</sup> As a consequence, people tend to flock to public tertiary general hospitals.  
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14 Unfortunately, the current medical care insurance system cannot relieve the catastrophic health  
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16 expenditure,<sup>5</sup> and residents often complain about high medical costs. Along with the factors social  
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18 change, incompetent medical education, and lack of professionalism in medical staff, most doctors  
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20 are only busy with aspects of technical problems; all of which result in a lack of awareness at the  
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22 humanistic level during the process of service.<sup>6</sup> This is an important reason why the  
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24 doctor-patient relationship is not harmonious in China.<sup>7</sup> Owing to the price of medical services  
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26 and technology, and income under strictly government-controlled conditions, there is an  
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28 unreasonable phenomenon where doctors' benefits from medical technology are very low in China.  
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30 Contrary to what the government wishes, in order to make a profit, some Chinese doctors try to  
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32 provide unreasonable prescriptions for the patients to earn more money;<sup>8</sup> some often  
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34 communicating unlawfully with drug/medical appliance dealers. Naturally, the Chinese  
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36 government attaches much importance to this problem, and many relevant policies have been  
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38 introduced to solve these issues. Regardless, this phenomenon has caused a large number of  
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40 adverse effects. Doctor-patient relationships are becoming more and more fragile in China,<sup>7</sup> and  
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42 most patients already do not trust doctors, including all other healthcare staff. In recent years,  
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44 many doctors have been assaulted, seriously injured, and even murdered by patients or visitors in  
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46 China. Consequently, doctors are at high risk of serious injury or death in hospital settings caused  
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by attacks from patients. Workplace violence (WPV) against doctors has already become a public health issue and a very common phenomenon in China .<sup>9</sup> Unfortunately, the reports of these incidents by the media have further exacerbated the conflict between doctors and patients .<sup>10</sup> Therefore, the occupational safety of Chinese doctors has come to a very grave juncture.

**Background**

WPV against healthcare workers is known as violence in healthcare settings, including the violent acts that are directed toward doctors, nurses, or other healthcare staff at work or on duty .<sup>11</sup> According to a survey, the prevalence of violence against emergency physicians in Morocco was 70% ,<sup>12</sup> in South Africa the proportion of personnel that had encountered violence rose to 61% and in Thailand, 54% .<sup>13</sup> In Jordan, a survey of nurses in the emergency department showed that 75% of emergency had experienced violence, among which verbal violence was the most common phenomenon, accounting for 63.9%, and physical violence accounted for 48% .<sup>14</sup> It has become an increasingly serious public health problem worldwide but is more common in China ,<sup>15</sup> and has attracted considerable attention and global discussion .<sup>16</sup> It is noteworthy that in recent years, WPV has become rampant and is an extensive problem in Chinese healthcare settings. However, it is also an ubiquitous, underreported, and persistent problem that has been tolerated and largely ignored .<sup>17</sup> Since 2002 in China, there is growing evidence that the incidence rate of WPV in healthcare settings has been increasing annually ;<sup>18</sup> and that the number of incidents of serious violence towards doctors is growing rapidly .<sup>19</sup> These findings demonstrate that China’s doctors are facing a severe threat to occupational safety. Furthermore, previous studies indicated that exposure to WPV in healthcare settings could lead to adverse consequences for health professionals, such as a decline in job performance ,<sup>20</sup> increased turnover intentions and reduced

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4 job satisfaction,<sup>21</sup> greater stress and burnout,<sup>22</sup> low quality of life,<sup>23</sup> and so on. Moreover,  
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6 exposure to violence has a negative effect on the health of hospital staff,<sup>24</sup> and due to the rise of  
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8 occupational stress, their family life and quality of life is affected as well.<sup>25</sup>  
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11 Research on WPV in healthcare settings has been widely carried out and revealed antecedent and  
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13 consequence variables in many previous studies.<sup>26 27</sup> However, most research focused only on  
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15 physical or psychological violence, the two types of violence that represent only the tip of the  
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17 iceberg. Classically, WPV is defined by the World Health Organization as “*the intentional use of*  
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19 *physical force or power, threatened or actual, against oneself, another person, or against a group*  
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21 *or community, that either results in or has a high likelihood of resulting in injury, death,*  
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23 *psychological harm, maldevelopment, or deprivation*”.<sup>28</sup> According to this definition, obscure  
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25 WPV tends to cause psychological harm, maldevelopment, or deprivation in the practices of  
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27 Chinese healthcare workers. A number of studies already reported about non-physical violence  
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29 against health care workers and its effects.<sup>29 30</sup> Surprisingly, these types of violence were not  
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31 considered in previous Chinese investigations. Thus, a wider range of types should be discussed  
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33 for violence against healthcare workers.  
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37 Still, it is generally known that WPV can cause a large number of adverse outcomes, which have  
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39 been verified widely, including personal, organizational and social-level outcomes. However, there  
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41 is not enough evidence to test the link between exposure to WPV against doctors, psychological  
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43 stress, sleep quality, and health status in China.  
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47 This study aims to identify the incidence rate of WPV against doctors under a new classification  
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49 by conducting a cross-sectional online survey; examine the association between exposure to WPV,  
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51 psychological stress, sleep quality, and subjective health of Chinese doctors; and the partial  
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mediating role of psychological stress.

**Methods**

Subjects and procedures

An anonymous online questionnaire was completed by doctors throughout the country during May 2016 in China. This cross-sectional study was conducted across 30 provinces of China. First, approximately 50 doctors from the authors’ unit were selected as the original deliverers of the survey. Subsequently, the colleagues or classmates of “the original deliverers” were invited to participate in our online survey. A webpage link to our questionnaire-survey (<https://www.wenjuan.com/>) was sent by mobile phone to subjects during doctors’ rest breaks. Moreover, the questionnaires were self-administered. A total of 3,016 participants were invited in this survey. Ultimately, 2,617 valid questionnaires were used in the final data analysis. The effective response rate was 86.8%.

The research described in this article meets the guidelines of the Ethics Committee of the College of Public Health, Harbin Medical University, and the project has been approved by the Ethics Committee of the Harbin Medical University (ECHMU). Written informed consent could not be received due to the anonymous survey approach. Hence, oral informed consent for the survey was approved by the ECHMU and obtained from each doctor. Once a questionnaire was completed, it was identified that the doctor has orally agreed to participate in our survey by reference to the Wen’s criteria<sup>19</sup>.

**Measures**

Measurement of the WPV against doctors

This study used a new measurement tool developed by Zhang to assess the prevalence of WPV.<sup>31</sup>

Under the new classification, WPV was divided into seven dimensions, including Verbal Violence (abuse, sarcasm, indignity, effrontery, roar, etc.), Made Difficulties (nit-picking demands, unreasonable-requests, non-compliance, heckling, etc.), Smear Reputation (baseless charges or complaints, slander, impudence for damaging reputation, etc.), Mobbing Behavior (destruction of public facilities, booing, gather together to stir up trouble, public disorder, malicious camera shooting, etc.), Intimidation Behavior (oral or written threats, glower, waving a clenched fist, threatening with weapons, stalking, etc.), Physical Violence (biting, pushing, fighting, cutting, throwing things towards body, etc.) and Sexual Harassment (also including rape or attempts to rape). Until now, made difficulties, smear reputation and mobbing behavior had been seriously neglected in previous studies. On the contrary, these behaviors very commonly trouble Chinese doctors at work, and exposure to such violence may lead to a great stress for doctors and threaten their well-being. Most importantly, these mistreatment behaviors completely meet the standards for the definition and scope of WPV.

In the present survey, we used a 6-point Likert scale, with “never”, rarely”, “occasionally”, “often”, “frequently” and “every day”, to reflect the frequencies of work-related violence against doctors. At the time of questionnaire coding, “never” and “rarely” were regarded as non-experience of WPV from patients or their relatives. Thus, they were assigned a score of “0.” Other situations were assigned a score of “1,” signifying that these doctors have encountered this type of violence during the past year. The Cronbach’s alpha for the scale was 0.885 in this survey.

### **Measurement of psychological stress, sleep quality and subjective health**

With reference to previous research, psychological stress<sup>24</sup> was used as an item to measure the

perceived pressure of doctors, rated on a 5-point Likert scale, ranging from 1 to 5 (1= not at all, 5 = very much). Two single items were addressed together to measure doctors' self-reported health outcomes (sleep quality & subjective health). Subjective sleep quality<sup>32</sup> was measured by using one item, namely, "How would you evaluate this night's sleep?", the response format for which ranged from very bad (1) to very good (4). Additionally, our study consulted the research of Fein and Skinner<sup>33</sup>, and estimated overall subjective health by a widely used single-item measure (In general would you say your health is ? 4=excellent, 3=very good, 2=good, 1=fair, poor). Moreover, this study also captured several demographic details of participants, such as: gender, age, service years, hospital level, marital status, educational categories, and so on.

**Statistical analysis**

Demographic characteristics of the respondents were collected to report sample information. Pearson's correlation coefficients were calculated to estimate correlations between the exposure to WPV, psychological stress, sleep quality, and self-subjective health. Multiple hierarchical linear regression analysis was performed to test the effects of groups of independent variables on dependent variables. The demographic variables related to WPV in univariate analysis ( $P<0.05$ ) were entered into step 1 of the hierarchical regression analysis model, to eliminate their interference on the dependent variables. A series of regression analyses were performed to examine our hypotheses according to a procedure that was suggested by Baron & Kenny.<sup>34</sup> The Sobel Test was used in mediation analysis by adopting Preacher's test program.<sup>35</sup> We provided data including  $F$ ,  $R^2$  and  $R^2$ -changes, and the fit of the model was assessed with  $R^2$ . Standardization regression coefficients ( $\beta$ ) and  $P$  values were calculated for each step in the regression model. In this study, statistical significance was set at  $P < 0.05$ (two-tailed). All of the

above analyses were conducted using SPSS 13.0 (SPSS, Inc., Chicago, IL) for Windows.

## Results

### Demographic characteristics of the respondents

A summary of demographic variables can be seen in Table 1.

**Table 1 Characteristics of the respondents (N=2617)**

Characteristic	N	%
<b>Age</b>		
20-30	587	22.4
31-40	1224	46.8
41-50	658	25.1
51+	119	4.5
Missing value	29	1.1
<b>Service Years</b>		
0-10	1088	41.6
11-20	720	27.5
30+	376	14.4
Missing value	433	16.5
<b>Hospital level</b>		
Tertiary hospitals	1740	66.6
Secondary hospital	733	28.1
Primary hospital	139	5.3
Missing value	5	2.0
<b>Gender</b>		
Male	1240	47.4
Female	1369	52.3
Missing value	8	3.0
<b>Education</b>		
College degree or below	291	11.1
Bachelor	1350	51.7
Master	692	26.5
Doctor	277	10.6

Missing value	7	3.0
<b>Marital status</b>		
Unmarried	397	15.2
Married	2148	82.1
Divorced or loss of spouse	70	2.7
Missing value	2	1.0
<b>Professional categories</b>		
Without professional title	306	11.7
Resident doctor	564	21.6
Attending physician	898	34.4
Associate chief physician	569	21.8
Chief Physician	270	10.4
Missing value	10	4.0
<b>Shift work</b>		
Often work during the day	503	19.2
Occasional work at night	500	19.1
Often work at night	1613	61.6
Missing value	1	0.1
<b>Working time (hour)</b>		
0-8	528	20.2
9-10	1297	49.6
11-12	504	19.3
13+	285	10.9
Missing value	3	0.1

**Prevalence of different styles of WPV against doctors**

As shown in Table 2, about 76.2% of participates reported having encountered verbal violence within the last 12 months, which is the highest incidence rate among all kinds of WPV in hospitals. Other incidence rates of WPV from highest to lowest are: made difficulties (58.3%), smear reputation (40.8%), mobbing behavior (40.2%), intimidation behavior (27.6%), physical violence (24.1%) and sexual harassment (7.8%).

**Table 2 The incidence rate and rank ordering of WPV against doctors within last 12 months**

Violence Styles	N	%	Total	Rank
Verbal Violence	1993	76.2	2616	1
Made Difficulties	1527	58.3	2616	2

Smear Reputation	1068	40.8	2615	3
Mobbing Behavior	1051	40.2	2615	4
Intimidation Behavior	721	27.6	2616	5
Physical Violence	631	24.1	2614	6
Sexual Harassment	203	7.8	2615	7

### Incidence rate of accumulated types of expose to WPV against doctors

As shown in Table 3, 83.4% of participants reported having experienced one or more types of WPV during the last 12 months, which indicates that the prevalence of WPV against doctors in China is 83.4%. Further, 18.8% of participants reported having suffered one type of violence, 14.9% of participants reported having encountered two types of violence, 14.1% of participants reported having experienced three types of violence, 11.7% of participants reported having suffered four types of violence, 9.8% of participants reported having suffered five types of violence, 10.0% of participants reported having suffered six types of violence, and 4.0% of participants reported having suffered seven types of violence.

**Table 3 Incidence rate of accumulated types of WPV against doctors within the last 12 months**

Accumulated Violence	N	%	Valid Percent	Cumulative Percentages
0	433	16.5	16.6	16.6
1 type	491	18.8	18.8	35.4
2 types	389	14.9	14.9	50.3
3 types	370	14.1	14.2	64.4
4 types	305	11.7	11.7	76.1
5 types	256	9.8	9.8	85.9
6 types	263	10.0	10.1	96.0
7 types	105	4.0	4.0	100.0

### Correlations between study variables



The means, standard deviations and Pearson correlation coefficients of continuous variables are shown in Table 4. As the results demonstrate, all variables were significantly correlated with each other. WPV was positively correlated with psychological stress ( $r= 0.382, P< 0.001$ ); and negatively associated with subjective sleep quality ( $r= -0.281, P< 0.001$ ), and subjective health ( $r= -0.471, P< 0.001$ ). Psychological stress was negatively related to subjective sleep quality ( $r= -0.281, P< 0.001$ ) and subjective health ( $r= -0.464, P< 0.001$ ).

**Table 4 Means (M), standard deviations (SD) and correlations of variables**

Variables	M	SD	1	2	3	4
1. WPV	2.75	2.10	1			
2. Psychological stress	3.33	0.861	0.382**	1		
3. Subjective sleep quality	2.29	0.763	-0.281**	-0.471**	1	
4. Subjective health	2.47	0.643	-0.302**	-0.464**	0.524**	1

\*\*  $p < 0.01$ .

**Multiple hierarchical linear regression models of study variables**

To evaluate the association between the exposure to WPV, psychological stress, sleep quality, and health status of doctors, we relied on the three-step mediated regression approach that Baron and Kenny (1986) recommend. Results of mediation analysis are shown in Table 5 illustrated that psychological stress is a partial mediator in the relationship between violence and sleep quality. Moreover, psychological stress also partially mediated the relationship between violence and subjective health.

**Table 5 Multiple hierarchical linear regression models of variables**

Variables	Psychological stress		Sleep quality				Subjective health			
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
<b>Control</b>										
<b>Variables</b>										
Age	0.019	0.065	0.059	0.068	0.024	0.053	-0.029	-0.021	-0.070	-0.042
Gender	-0.001	-0.026	-0.009	-0.011	0.007	-0.005	0.013	0.012	0.032	0.022
Service	-0.057	-0.061	0.007	-0.020	0.011	-0.016	0.076	0.048	0.082	0.056

Years										
Education	0.041	0.039	0.072**	0.093***	0.074***	0.092***	0.042	0.062**	0.044	0.060**
Marital status	0.028	0.033	-0.039	-0.025	-0.041	-0.027	-0.039	-0.025	-0.042	-0.028
Professional categories	0.090**	0.043	-0.044	0.000	-0.010	0.010	-0.081*	-0.038	-0.042	-0.024
<b>Mediating variable</b>										
Psychological stress			-0.488***		-0.448***			-0.479***		-0.424***
<b>Independent variable</b>										
WPV		0.378***			-0.275***	-0.106***			-0.307***	-0.146***
F	4.099***	55.047***	2.163*	97.365***	26.769***	89.137***	2.130*	93.109***	33.397***	89.762***
R <sup>2</sup>	0.011***	0.153***	0.006*	0.242***	0.081***	0.250***	0.006*	0.233***	0.098***	0.251***
ΔR <sup>2</sup>	0.011***	0.141***	0.006*	0.236***	0.075***	0.244***	0.006*	0.227***	0.093***	0.246***

\*  $p < 0.05$ ,

\*\*  $p < 0.01$ ,

\*\*\*  $p < 0.001$  (two-tailed).

## Discussion

### New styles and prevalence of WPV against doctors in China

This study discovered that the incidence rate of WPV against Chinese doctors was 83.4%, similar to previous reports.<sup>36</sup> Of all participants in this survey, most have encountered and been victims of at least two styles of violence in the last 12 months. Specifically, exposure to verbal violence was most frequently reported by Chinese doctors with a rate of 76.2%. This result is consistent with previous studies.<sup>36 37</sup> Results in the present study demonstrate that Chinese doctors extensively suffer WPV from patients or their relatives. However, compared to the previous literature, this study specially contributes to the understanding of the types of WPV. Made difficulties, smear reputation, and mobbing behavior were proposed first in this study, and it verified that the three new styles of violence defined in our study appeared to be more common than physical violence in

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hospital settings. Their respective incidence rates were, 58.3% (Rank 2), 40.8% (Rank 3), and 40.2% (Rank 4). Additionally, the incidence rate of physical violence and sexual harassment was 24.1% and 7.8%. Indeed, physical violence must inflict greater harm on the doctors, but the type of widespread violence found in this study is more likely to harm healthcare staff continually.

**The adverse effects of WPV against doctors and the partial mediatory effects of psychological stress**

As its name implies, WPV threatens the well-being of doctors, which we have demonstrated in our findings. Consistent with previous observations,<sup>38</sup> exposure to WPV had a negative influence on Chinese doctors' subjective sleep quality and health status. There is reciprocal causation between the doctor-patient relationship and violence towards doctors.<sup>2</sup> Although previous literature has discussed numerous causes of WPV and specially their unique characteristics in China, it is not the focus our discussion.<sup>39</sup> However, it is undeniably true that the level of tension in the doctor-patient relationship has further intensified following the increase of WPV.<sup>19 40</sup> It is incredible to see that some Chinese netizens unexpectedly support these violent events,<sup>41</sup> and a gradual formation of hatred towards doctors among Chinese patients; thus, the doctor-patient relationship has reached an unprecedentedly poor condition. Under these circumstances, Chinese doctors tend to specifically allocate much of their attention in dealing with the doctor-patient relationship, in order to protect themselves against violence from patients or patients' relatives. Therefore, doctors need to carefully express every word and input more "emotional labor"<sup>42</sup> when they directly face the patient or relatives to avoid the complain. In order to avoid exposure to WPV, Chinese doctors are prone to invest more resources such as extra time and energy in dealing with the doctor-patient relationship.<sup>43</sup> On the one hand, the resource investment represents the

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4 accumulative job demands of a doctor; on the other hand, they suffer from the patient's violence.  
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6 In this case, two aspects may trigger feelings of distress and outrage in a doctor. It is an  
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8 inequitable cost-reward evaluation of a doctor's professional and emotional investment, resulting  
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10 in a process of resource depletion for the doctor. This state of resource depletion is closely related  
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12 to stress, burnout, and depression.<sup>44</sup> More than that, a large number of previous studies have  
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14 shown that effort-reward imbalance can lead to adverse health outcomes.<sup>45 46</sup> In turn, the  
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16 psychological stress that plays a mediating role, several importantly longitudinal studies had  
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18 proved that the relationship between violence and stress is circular: violence causes stress, and  
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20 stressed workers are prone to violence.<sup>47 48</sup> Further causes sleep disturbance and health damage  
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22 for a doctor, which is an innovative contribution to research on exposure to WPV in a medical  
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24 setting.  
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### 34 Limitations

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36 Although there are significant discoveries in the present study, it has several limitations. First, a  
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38 convenient sample was used, which risks the potential for sampling bias. Second, its  
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40 cross-sectional nature prevented the establishment of a causal relationship between variables.  
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42 Therefore, one important suggestion is that longitudinal studies should be conducted in the future.  
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45 Third, the data were collected from the self-reports of doctors in an online survey, which may have  
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47 led to response bias due to social desirability or negative effect. The doctors might have  
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49 overestimated or underestimated the association between the study variables. Fourth, a specifically  
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51 developed measurement tool using the Chinese validation has a great limitation. The validity of  
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53 tool in this study need to further test. The choice to measure psychological stress, sleep quality and  
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subjective health with one or two items weakens the assessment and shorten the validity of the measure tools. Fifth, convenient sample, which is very small sample if compared to the Chinese doctors population, and without control of confounders. Moreover, the survey process of could not be monitored. Therefore, a rigorous sampling techniques and a larger samples are needed in future research. The samples in this study were large, however, these doctors were a small number of Chinese doctors. Moreover, considering of the sampling characteristics, the results of the study are not generalizable to all Chinese doctors .

**Conclusions**

The findings indicate that 83.4% of participants reported that they had suffered more than one type of WPV. Exposure to WPV toward Chinese doctors is common. All the seven styles of WPV were found among Chinese doctors. The incidence rate of violence from high to low are verbal abuse, made difficulties, smear reputation, mobbing behavior, menace behavior, physical violence and sexual harassment. This study also demonstrated that WPV was associated with psychological stress, sleep quality, and subjective health. Finally, this study made a new discovery regarding a rarely mentioned variable in the previous literature; psychological stress played a mediating role in the relationship between exposure to violence and health damage.

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**Author Contributions:** Conceived and designed the study: Tao Sun, Lei Gao and Fujun Li designed this study; Sun Tao, Lei Gao and Fujun Li drafted the manuscript; Yu Shi, Fengzhe Xie, Jinghui Wang, Shuo Wang, and Shue Zhang collected data and controlled quality; Wenhui Liu, Xiaojian Duan, Xinyan Liu, Zhong Zhang, Li Li and LiHua Fan conducted the data analyses. All authors contributed to publishing the final manuscript.

**Competing Interests:** The authors have declared that no competing interests exist.

**Ethics:** This study was approved by the ethics committee of the College of Public Health, Harbin Medical University. Due to the anonymous survey approach, the written informed consent could not be received; therefore, oral informed consent for survey was approved by the Ethics Committee of Harbin Medical University and obtained from each participant.

**Data sharing statement:** No additional data are available.

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	Page 1, line 2; p. 2 , line 11
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	P.2 ; line 20; p.3, line 1-14
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	p.5, line 5-22; p.6, line 1-19
Objectives	3	State specific objectives, including any prespecified hypotheses	P.6, line 20-22; p.7, line 1
Methods			
Study design	4	Present key elements of study design early in the paper	P.7, line 4-13
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	p.7, line 4-13
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	P.7, line 7-10
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	no
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	P.7, line 22; p.8; p.9, line 1-9
Bias	9	Describe any efforts to address potential sources of bias	no
Study size	10	Explain how the study size was arrived at	no

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	p.9, line 10-22; p.10, line 1
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	P.9, line 11-15
		(b) Describe any methods used to examine subgroups and interactions	no
		(c) Explain how missing data were addressed	no
		(d) If applicable, describe analytical methods taking account of sampling strategy	P.9, line 15-22
		(e) Describe any sensitivity analyses	no
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	P.7, line 11-12
		(b) Give reasons for non-participation at each stage	no
		(c) Consider use of a flow diagram	No
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	P.10; p.11
		(b) Indicate number of participants with missing data for each variable of interest	P.10; p.11
Outcome data	15*	Report numbers of outcome events or summary measures	P.11; p.12; p.13; p.14
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	P.9, line 15-17
		(b) Report category boundaries when continuous variables were categorized	no
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	no
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	no
Discussion			
Key results	18	Summarise key results with reference to study objectives	P.14, line 15-25; p.15. Line 1-19
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and	P. 16, Line 13-22;

		magnitude of any potential bias	p.17, line 1-7
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	P.15, line 9-22; p.16, line 1-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	no
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	P.17, line 22; p.18, line 2

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).